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TITLE: **SLIDING FASTENING SYSTEM**

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SLIDING FASTENING SYSTEM

BACKGROUND OF THE INVENTION

This invention is directed to a sliding fastening system having male and female components. A number of fastening systems, such as diaper fastening systems, incorporate a hook and loop system for easy fastening and release. The hook component typically includes a flat plastic sheet laminate with a number of protruding hooks that engage with a number of loops protruding from a corresponding loop component. Individual hooks engage with individual loops. Such hook and loop fastening systems rely primarily on shear forces that resist unfastening.

Since the shear forces resist unfastening of the hook and loop fastening system, hook and loop components are typically separated from one another using peel forces. However, with little resistance to the peel forces, the hook and loop fastening system is susceptible to coming unfastened at unexpected, and often undesirable, times.

There is a need or desire for a hook and loop fastening system with improved fastening security.

SUMMARY OF THE INVENTION

The present invention is directed to a fastening system having a male component and a female component wherein the male component can slide into a cavity in the female component, with hook and loop fasteners located on the inner

surface of the cavity of the female component and on a surface of the male component, thereby creating enhanced engagement qualities. The male component can be completely inserted into the cavity of the female component, thereby keeping the hooks or loops on the male component away from the wearer's skin. This design reduces the likelihood of the fastener inadvertently popping open and, furthermore, provides a discrete appearance particularly when used in disposable garments such as incontinence wear for children or adults, disposable swimwear, and the like.

In order to unfasten the fastening system, part of the female component, suitably one wall of the cavity, can be peeled back away from the male component, thus allowing the male component to essentially pop out of the cavity. In another embodiment having more enhanced security, the fastening system can be unfastened by peeling part of the female component away from the male component, thus exposing the male component as it was inserted in the cavity. The male component can then be peeled away from a remaining portion of the female component.

With the foregoing in mind, it is a feature and advantage of the invention to provide a separable fastening system with improved fastening security.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a front view of fastening system including a male component and a female component prior to engagement;

Fig. 2 is a cross-sectional view of one embodiment of the fastening system taken along line 1-1 in Fig. 1;

Fig. 3 is a cross-sectional view of another embodiment of the fastening system taken along line 1-1 in Fig. 1;

Fig. 4 is a cross-sectional view of yet another embodiment of the fastening system taken along line 1-1 in Fig. 1;

Fig. 5 is a cross-sectional view of still another embodiment of the fastening system taken along line 1-1 in Fig. 1;

Fig. 6 is a front view of the fastening system of Fig. 1 showing a first step of unfastening the system; and

Fig. 7 is a front view of the fastening system of Fig. 1 showing a second step of unfastening the system.

DEFINITIONS

Within the context of this specification, each term or phrase below will include the following meaning or meanings.

"Cavity" refers to a pocket-like receptacle or a hollow area in which an object can be inserted.

"Medical garment" includes medical (i.e., protective and/or surgical) gowns, caps, gloves, drapes, face masks, blood pressure cuffs, bandages and the like.

"Polymers" include, but are not limited to, homopolymers, copolymers, such as for example, block, graft, random and alternating copolymers, terpolymers, etc. and blends and modifications thereof. Furthermore, unless otherwise specifically limited, the term "polymer" shall include all possible geometrical configurations of

the material. These configurations include, but are not limited to isotactic, syndiotactic and atactic symmetries.

"Releasably attached," "releasably engaged" and variations thereof refer to two elements being connected or connectable such that the elements tend to remain connected absent a separation force applied to one or both of the elements, and the elements being capable of separation without substantial permanent deformation or rupture. The required separation force is typically beyond that encountered while wearing an absorbent garment.

"Thermoplastic" describes a material that softens when exposed to heat and which substantially returns to a nonsoftened condition when cooled to room temperature.

These terms may be defined with additional language in the remaining portions of the specification.

DETAILED DESCRIPTION OF THE PRESENTLY PREFERRED EMBODIMENTS

The present invention is directed to a separable fastening system, including a male component and female component, that can remain fastened under high levels of activity. More particularly, the female component forms a cavity or pocket into which the male component slides. When the male component slides into the female component, the male and female components are releasably attached, or releasably engaged, to one another. More particularly, the female component can have either hooks or loops on an inner surface of the cavity and the male component

can have corresponding loops or hooks on at least one surface of the male component. The hooks and loops on the male and female components create releasable engagement between the two components when the male component is slid into the female component.

This fastening system is particularly suitable for use on disposable absorbent articles. Examples of such suitable articles include diapers, training pants, feminine hygiene products, incontinence products, swimwear, other personal care or health care garments, including medical garments, or the like.

A fastening system 20 of the invention is illustrated in Fig. 1. The female component 22 includes a cavity 24 between a first side 26 and a second side 28. The first side 26 and the second side 28 can form an angle of between about 1 degree and about 45 degrees, suitably between about 1 degree and about 30 degrees, most suitably between about 1 degree and about 20 degrees, with the cavity 24 defined therebetween. An inner surface 30 of the first side 26 and/or the second side 28 can include a number of individual hooks 32 protruding generally perpendicularly from a hook backing material 34 (Figs. 4 and 5), or alternatively, can include a number of individual loops 36 protruding generally perpendicularly from a loop backing material 38 (Figs. 2 and 3). More suitably, the individual hooks 32 protrude from the hook backing 34 at an angle such that projections on the individual hooks 32 are angled toward the direction of fastener shear force. Angled hooks are described in greater detail in U.S. Patent Application Serial No. 09/637,307 filed

11 August 2000, which is hereby incorporated by reference. The first side 26 and the second side 28 can be one continuous piece of hook backing 34 or loop backing material 38 with the first side 26 folded over the second side 28 to form the cavity 24, or alternatively, can be two separate pieces of the same or different types of material attached to one another along at least one edge of each piece to form the cavity 24. The hooks 32 or loops 36 protruding from the female component 22 are suitably inside the cavity 24.

Also shown in Fig. 1, the male component 40 is generally a flat, two-dimensional component having a first surface 42 and a second surface 44. The first surface 42 and/or the second surface 44 of the male component can include a number of individual hooks 32 protruding generally perpendicularly or at an angle from a hook backing material 34 (Figs. 2 and 3), or alternatively, can include a number of individual loops 36 protruding generally perpendicularly or at an angle from a loop backing material 38 (Figs. 4 and 5). The male component 40 can be a single, continuous piece of hook backing 34 or loop backing material 38 folded in half or in another suitable proportion so that the first surface 42 and the second surface 44 both have hooks 32 or loops 36 protruding therefrom, as shown in Figs. 2 and 4. The embodiments shown in Figs. 3 and 5 provide enhanced security over conventional male and female fastening systems and are sufficient for most intended uses, while the embodiments shown in Figs. 2 and 4 provide even greater fastening security than the embodiments shown in Figs. 3 and 5.

More specifically, in an embodiment in which the female component 22 has a loop backing 38 and individual loops 36 on the inner surface 30 of the first side 26 and/or the second side 28 of the component 22, then the first surface 42 and/or the second surface 44 of the male component 40 has a hook backing 34 and individual hooks 32 protruding from it, as shown in Figs. 2 and 3.

Likewise, in an embodiment in which the female component 22 has a hook backing 34 and individual hooks 32 on the inner surface 30 of the first side 26 and/or the second side 28 of the component 22, then the first surface 42 and/or the second surface 44 of the male component 40 has a loop backing 38 and individual loops 36 protruding from it, as shown in Figs. 4 and 5.

To fasten the fastening system 20, the male component 40 is slid into the cavity 24 of the female component 22. The individual hooks 32 and the individual loops 36 are brought into contact with one another and engage with one another when tension is applied by pulling back on either the male component 40 or the female component 22, with the hooks 32 latching onto the loops 36, thereby holding the male component 40 within the cavity 24 of the female component 22. Such tension can be imparted by other components of the application to which the fastening system 20 is applied. For example, when used on a disposable diaper or training pant, stretchable ears along the side of the garment are typically stretched while applying the garment to the wearer, and the retraction of the stretchable ears would provide tension to engaged the individual hooks 32 and the individual

loops 36. Engagement through tension in this manner is particularly strong when the individual hooks 32 are angled, as described above.

To unfasten the fastening systems 20 shown in Figs. 3 and 5, at least part of the first side 26 of the female component 22 can be peeled back in a direction away from the second side 28 of the female component 22, essentially folded back about 90 degrees, as shown in Fig. 6. By peeling the first side 26 of the female component 22 back in this manner, the first side 26 of the female component 22 is forcibly separated from the male component 40 by pulling the hooks 32 out of the loops 36, thereby allowing the male component 40 to easily slip out of the cavity 24. While the embodiments shown in Figs. 3 and 5 are secure, they are no more difficult to unfasten than conventional hook and loop fastening systems.

To unfasten the fastening systems 20 shown in Figs. 2 and 4, at least part of the first side 26 of the female component 22 can be peeled back in a direction away from the second side 28 of the female component 22, essentially folded back about 90 degrees, as shown in Fig. 6. By peeling the first side 26 of the female component 22 back in this manner, the first side 26 of the female component 22 is forcibly separated from the male component 40 by pulling the hooks 32 out of the loops 36, thereby allowing easy access to the male component 40 in order for the male component 40 to be peeled away from the second side 28 of the female component 22, as shown in Fig. 7.

In each of the embodiments, the individual loops 36 of either the female component 22 or the male component 40 can be needled, stitched or otherwise projected through the loop backing material 38, which can suitably be made from a nonwoven material. The individual loops 36 can suitably be made from a fibrous nonwoven web such as a spunbond nonwoven web, or a staple fiber carded web. Alternatively, the individual loops 36 can be made of yarn or tow. Once the loops 36 have been formed, fibers forming the loops 36 can be anchored in place by bonding the fibers to the loop backing material 38 with heat and/or adhesives or any other suitable means.

The loops 36 are not necessarily of a uniform height, but preferably have a height in a range of from about 0.00254 cm to about 0.19 cm, or from about 0.0381 cm to about 0.0762 cm. The loop backing 38 generally has a thickness in a range of between about 0.025 millimeter (mm) and about 5 mm, suitably between about 0.4 mm and about 2 mm. The density of the loops 36 on the loop backing 38 is largely dependent on the type of material used, and can range from about 16 to about 620 loops per square centimeter, or from about 124 to about 388 loops per square centimeter, or from about 155 to about 310 loops per square centimeter.

In each of the embodiments, the individual hooks 32 of either the male component 40 or the female component 22 typically have a base portion that extends roughly perpendicularly from the hook backing 34 and a free end extending from the base portion that is curved or angled to enable engagement with a corresponding

loop 36 on the corresponding female 22 or male component 40. Virtually any hook shape can be used with this invention. For example, the individual hooks 32 can have J-shaped free ends or flat free ends. The hooks 32 are typically co-formed with the hook backing material 34. A co-extrusion process can be employed to form the individual hooks 32 and the backing material 34 from various polymers in the same process.

Suitable hook backings 34 generally have between about 16 and about 620 hooks per square centimeter, or between about 124 and about 388 hooks per square centimeter, or between about 155 and about 310 hooks per square centimeter. The hooks 32 suitably have a height of from about 0.00254 centimeter (cm) to about 0.19 cm, or from about 0.0381 cm to about 0.0762 cm. In addition to the processing improvements disclosed herein, the hooks 32 are suitably molded or extruded from a thermoplastic polymer. Suitable polymers include polyolefins, polyamides, polyesters, polytetrafluoroethylenes, elastomeric thermoplastic polymers made from block copolymers such as polyurethanes, copolyether esters, polyamide polyether block copolymers, polyester block amide copolymers, ethylene vinyl acetates (EVA), block copolymers having the general formula A-B-A' or A-B like copoly(styrene/ethylene-butylene),styrene-poly(ethylene-propylene)-styrene,styrene-poly(ethylene-butylene)-styrene, (polystyrene/poly(ethylene-butylene)/polystyrene, poly(styrene/ethylene-butylene/styrene) and the like.

Other exemplary elastomeric materials which may be used include polypropylene, polyethylene, or polyurethane elastomeric materials. Examples of such polyurethane elastomeric materials include those available under the trademark ESTANE® from B. F. Goodrich & Co. or MORTHANE® from Morton Thiokol Corp., polyester elastomeric materials such as, for example, those available under the trade designation HYTREL® from E.I. du Pont de Nemours & Company of Wilmington, Delaware, and those known as ARNITEL®, formerly available from Akzo Plastics of Arnhem, Holland and now available from DSM of Sittard, Holland.

Metallocene catalyzed polymers are another type of material suitable for the hooks 32 of the present invention. This class of polymers is well known in the art for having excellent elasticity, and a narrow polydispersity number, e.g., Mw/Mn is 4 or less and may be produced according to the metallocene process. The metallocene process generally uses a catalyst which is activated, i.e. ionized, by a co-catalyst.

Likewise, the hook backing material 34 can be made of any of these or any other suitable materials. The hook backing material 34 generally has a thickness in a range of between about 0.5 millimeter (mm) and about 5 mm, suitably in a range of between about 0.8 mm and 3 mm, with a basis weight in a range of from about 20 grams per square meter to about 70 grams per square meter.

A fastening system that can remain fastened under high levels of activity results from any of the disclosed embodiments.

It will be appreciated that details of the foregoing embodiments, given for purposes of illustration, are not to be construed as limiting the scope of this invention. Although only a few exemplary embodiments of this invention have been described in detail above, those skilled in the art will readily appreciate that many modifications are possible in the exemplary embodiments without materially departing from the novel teachings and advantages of this invention. Accordingly, all such modifications are intended to be included within the scope of this invention, which is defined in the following claims and all equivalents thereto. Further, it is recognized that many embodiments may be conceived that do not achieve all of the advantages of some embodiments, particularly of the preferred embodiments, yet the absence of a particular advantage shall not be construed to necessarily mean that such an embodiment is outside the scope of the present invention.